



WHAT IS CLAIMED IS:

1. A digital signal processing device to which after digital signals are subjected to predetermined processing, a processed digital signal having signal amplitude values exceeding signal amplitude values of said digital signals is inputted, said digital signal processing device comprising:

first delta sigma modulating means including first quantizing means having quantized amplitude values allowing at least quantization of signal amplitude of said inputted processed digital signal; and second delta sigma modulating means including second quantizing means having quantized amplitude values equal to the signal amplitude values of said digital signals for quantizing a modulated signal outputted from said first delta sigma modulating means.

2. The digital signal processing device as claimed in claim 1, wherein said second delta sigma modulating means further includes delaying means for delaying a part of a quantized signal outputted from said first quantizing means and outputting the delayed part to said second quantizing means when quantized data outputted from said first quantizing means has an amplitude value exceeding the quantized amplitude values of said second quantizing means.

3. The digital signal processing device as claimed in claim 1, wherein said first quantizing means of said first delta sigma modulating means performs quantization with quantized values each comprising  $n$  bits ( $n$  is 2 or more), and uses two values having zero interposed between the two values and separated from the two values by equal quantities and values having a difference equal to a difference between the two values as the quantized values.

4. The digital signal processing device as claimed in claim 3, wherein said second quantizing means of said second delta sigma modulating means uses values equal to two least significant quantized values of the quantized values of said first quantizing means as quantized values.

5. The digital signal processing device as claimed in claim 1, wherein said second quantizing means of said second delta sigma modulating means averages energy by converting a delta sigma modulated output of said first delta sigma modulating means to one bit.

6. A digital signal processing method in which digital signals are subjected to predetermined processing, and a processed digital signal having signal amplitude values exceeding signal amplitude values of said digital signals is inputted, said digital signal processing method comprising:  
a step for subjecting said inputted processed digital signal to delta sigma modulation, and quantizing amplitude of said delta sigma modulated signal with at least quantized values not less than the amplitude values of said processed digital signal; and  
a step for quantizing said quantized modulated signal into quantized amplitude values equal to the signal amplitude values of said digital signals.

7. The digital signal processing method as claimed in claim 6, wherein when quantizing said quantized modulated signal into the quantized amplitude values equal to the signal amplitude values of said digital signals, processing for quantizing a part where a quantized value of said quantized modulated signal exceeds the signal amplitude values of said digital signals is delayed.

8. The digital signal processing method as claimed in claim 6, wherein the signal obtained by subjecting said inputted processed digital signal to delta sigma modulation is quantized by  $n$  bits ( $n$  is 2 or more), and two values having zero interposed between the two values and separated from the two values by equal quantities and values having a difference equal to a difference between the two values are used as quantized values.

9. The digital signal processing method as claimed in claim 8, wherein the step for quantizing said quantized modulated signal into the quantized amplitude values equal to the signal amplitude values of said digital signals uses values equal to two least significant quantized values of the quantized values for quantizing said quantized modulated signal into the quantized amplitude values equal to the signal amplitude values of said digital

signals as quantized values.

10. A digital signal processing device to which after digital signals represented by one bit are subjected to predetermined signal processing, a digital signal processed signal having signal level exceeding said one bit is inputted, said digital signal processing device comprising:

first quantizing means for outputting two values having zero interposed between the two values and separated from the two values by equal quantities and values having a difference equal to a difference between the two values as a first group of quantized values each comprising  $n$  bits ( $n$  is 2 or more); and

second quantizing means for outputting values equal to two least significant quantized values of the first group of quantized values outputted by said first quantizing means as a second group of quantized values;

wherein said second quantizing means averages energy of said first group of quantized values outputted by said first quantizing means and outputs said second group of quantized values.

11. The digital signal processing device as claimed in claim 10, further comprising integrating means disposed between said first quantizing means and said second quantizing means, for integrating said first group of quantized values and supplying an integration result to said second quantizing means,

wherein said integrating means accumulates an amount of excess of said first group of quantized values outputted by said first quantizing means over said second group of quantized values, adds an opposite sign in timing in which the amount of excess is dischargeable, and supplies the amount of excess to said second quantizing means.

12. The digital signal processing device as claimed in claim 11, wherein second quantizing means outputs said second group of quantized values in such a manner as to retain a total amount of energy of said first group of quantized values.

13. The digital signal processing device as claimed in claim 11, wherein said second quantizing means outputs two least significant values of said first group of quantized values as they are after said amount of excess is cleared from said integrating means.